SYNAESTHESIA AND MEANING

By RAYMOND HOLDER WHEELER, Ph.D., and THOMAS D. CUTSFORTH
University of Oregon

TABLE OF CONTENTS

1. INTRODUCTION

Although a vast amount of literature on synaesthesia has accumulated over a period of time as long as a century and a half, the real root of the problem seems never to have been unearthed,[1] and the difficulty has been that no investigator has attacked the problem intensively from an introspective point of view.

The investigation herein reported aims to describe the functioning of synaesthetic phenomena in a blind subject and to offer as check data the results from similar experimentation upon a second blind subject who is asynaesthetic. The data were obtained at different intervals of time from 1916-1921, but always under the same conditions and with carefully guarded instructions. Our synaesthetic subject, Thomas D. Cutsforth (*A*), is a graduate student in psychology and a well trained introspector. He lost his sight at the age of eleven. Our other blind subject (*B*), Leslie C. Blades, is likewise a well trained introspector, and at the time of experimentation was an advanced student in psychology. He lost his sight at the age of nine.

[1]See R. H. Wheeler, The Synaesthesia of a Blind Subject, *Univ. of Ore. Pubs.*, i, No. 5, 1920.

Owing to the fact that during part of the investigation observer *B* was not available, data from a third subject (*W*), the senior writer, have been used as check material.

The present study falls into two parts: (1) an analysis of the process of recognizing, and (2) a study of the development of meaning. The instructions to the reagents will serve as a description of method.

2. Group 1. Experiments on Recognition

Instructions to B.—"I shall present to you a Braille letter, punched in the middle of a rectangular piece of tag-board. You will find the tag-board located on the table directly in front of you and in a small wooden frame. I shall give you a ready signal, followed by 'now', whereupon you are to inspect the letter in normal fashion as if reading. The instant you have recognized the letter, stop and begin your introspection at once. Ready, now."

(*a*) *Typical Introspective Data*

1. *Observer B.* "(The letter was 'l'.) The *Aufgabe* was present to consciousness in terms of a focal perception of *E*'s voice, together with incipient tendencies for the fingers of my right hand to assume the position of investigating a point-letter and the vocal-motor-auditory: 'Wonder what it will be.' As I began to make the arm and finger movements across the tag-board from left to right consciousness was occupied with tactual sensations of smoothness and kinaesthetic sensations of keeping my finger in the proper position; these latter were localized principally about the wrist and elbow. During this procedure, however, my attention was centered tactually upon the tip of my second finger and I was conscious of a tactual 'set' or 'anticipation', a preparedness to receive an actual tactual impression of a point, part of which was also incipient strain localized in the finger and knuckle joints. Along with this 'set' were tensions about the brows and shoulders. Then I was tactually aware of touching the first point, the outstanding feature of which at the outset was a momentary consciousness of something other than smooth surface; this consciousness did not develop into a full-fledged awareness of a distinct point, but turned at once into an awareness of a solid line running at right angles to my finger movement. All of this occurred while the right side of my finger was in contact with the points and while the left-hand side of the finger was still resting upon smooth surface; in the fringe of consciousness there still lingered an awareness of this smooth surface. There then developed a very fleeting and vague tactual image of the letter 'l'; I noticed the difference between this tactual image and the perception which had thus far developed; the perception had as yet no definite ends either at the top or the bottom; it was merely the perception of a line; but the image contained a definite height; that is, the distinctive features of the perception were its straightness and direction while the distinctive feature of the image was its vertical length. I then found myself hesitating momentarily—a suspension of judgment—consisting merely of a slight tendency to inhibit arm and finger movement and of rising tensions in my throat and shoulders. I then moved my finger until the points fell beneath the middle of the fingertip; this movement was not straight to the right but was made in the form of a tiny arc; thereupon the letter clarified, first by a momentary standing out in focal tactual consciousness of the top point, the lower two points re-

maining as a bar or solid line. While the upper dot was thus being focalized I was momentarily conscious of its roundness and smallness. There then reappeared the tactual image of 'l', which entered consciousness very suddenly and developed at once to a high degree of clearness. I then found myself saying 'l' and began to relax, generally. During the entire process I was not conscious of familiarity as such. In fact the instant my tactual image of the 'l' appeared I began to relax."

2. *Observer B.* [Similar instructions, except that a New York Point letter was used.] "(The letter was New York Point 'f'.) As before, I was first aware of tactual and kinaesthetic sensations having to do with approaching the points from the left. The first point appeared as a localized, blunt pressure, with attention momentarily taking in the roundness and smallness of the point, while tapering off in consciousness was the smoothness of the paper against the left half of the ventral surface of my finger-tip. Then as my finger covered the letter as a whole I did not perceive the individual points; first there appeared a tactual bar or line with no definite beginning or ending; as this 'line'-consciousness lingered for an instant the three points became distinct, arranged in a straight line. Then there appeared a vague tactual image of a short line—its shortness and direction being the only definite features—in response to which I found myself relaxing and at the same time having the vocal-motor-auditory: 'f'."

Instructions: "I am about to present you with an object which you are to recognize tactual fashion. It will be located in the center of a rectangular piece of tag-board and the tag-board will be in a cardboard frame. Place your finger here (*E* guided *A*'s hand) opposite and to the left of the object. When I say 'ready' approach it slowly and as soon as you have recognized it begin to introspect."

3. *Observer A.* "As I laid my finger upon the tag-board and began to move across toward the right I was conscious of wondering what the object might be....., of the smoothness of the paper, and of kinaesthetic sensations in fingers, wrist and elbow. Then my attention was claimed, tactually, by a localized and rather sudden welling-up of a pressure sensation which did not develop into a consciousness of a Braille point but merely into the awareness of something blunt. The instant the above tactual impressions appeared I began to visualize the yellow of the tag-board; but when I came in contact with the first point my attention was absorbed with the change from smoothness to bluntness. Before this consciousness developed very far I became aware of two more blunt points localized adjacent to the first one; here attention centered momentarily upon the mid-position between the latter two points. There then at once appeared visual imagery of a jeweled pin, only the head of which stood out focally in consciousness; it was localized at my finger-tip and was followed very suddenly by incipient finger movement upward and to the left as if to ascertain if the pin would roll when I moved it. This visual image was fleeting and vague, involving merely a small area of yellow with two bright spots in the center. There then developed an awareness that the jewels might be set in the form of a cross, whereupon I found myself making very slight and incipient finger movements of exploring for the other jewels. In this process my finger came in contact with a point above those which I had already perceived; the instant this point appeared I found my attention grouping the three left-hand points spatially; the three-ness of the points gave way to a tactual line in which direction and length stood out as its prominent features. During this time the yellow and white of the visualized jeweled pin had been persisting. But now the tactual perception enlarged to take in the fourth point, on the right of the figure, and

at this instant the jeweled pin vanished, and suddenly taking its place was a yellowish-red blotch localized at my finger-tip; momentarily the tactual processes entirely receded from consciousness and I found my attention entirely absorbed with this patch of color, which was stable, clear and vivid. Then I found myself tending to relax; muscles loosened about the fingers, wrist, arm and shoulders, together with tendencies to take a long breath. This relaxation might have been interpreted as a feeling of familiarity, but I was not aware of it at the time as such. The appearance of the yellowish-red was my identification of the letter as 'k'. I had no vocal-motor imagery or other identifying imagery until after I knew that it was 'k'; the color informed me that the letter was 'k'. "

4. *Observer A.* (Same instructions. *A* was aware that the object would be a Braille letter.) "The fore-period consisted of visual-tactual and visual-motor processes having to do with anticipating Braille letters. On beginning to move my hand to the right and slightly upward along the paper, as is my custom when reading point letters, I was first conscious of tactual-kinaesthetic-visual smoothness of the paper and of arm-movement. Upon reaching the first point I received a blunt tactual sensation together with visual imagery of the point raised up like a tiny knob from the surface of the tag-board and colored the yellow of tag-board. The second point was perceived and visualized in a similar fashion. But I had no sooner perceived the second dot than the two became spatially arranged in an oblique line slanting down and to the right. There followed a very sudden recognition of the letter as 'o', which consisted of a sudden change from the yellow-buff tag-board color in which I had been visualizing the points into a very light, faded potato-peeling-grey—an almost colorless, watery grey—tinged with a faint bluish darkness. But no sooner had this latter visual process developed than it was interrupted in its course by a tactual perception of another point above those which I had already detected. Before this latter tactual consciousness had grown into a definite tactual-visual awareness of a point I found myself in kinaesthetic fashion tending to make the bend formed by the three points; this was a fleeting and vague image but was localized in my fingers and wrist. Immediately following was the sudden appearance of a small bluish black area localized at my finger-tip, the visual image tending, as it developed, to assume the shape of the figure formed by the three points. Here my attention was centered upon the darkness, hue and shape of the visual process and the tactual elements entirely receded from consciousness. The color appeared suddenly and with no warning, the immediate antecedent of which was the motor image just described; it seemed as if the visual image instead of tactual processes were coming from my finger-tip; so sudden was the advent into consciousness of this visual image that it had developed before my finger had fairly covered the last point in the letter; immediately upon the advent of this visual image I relaxed. During the false recognition of the letter as 'o', tensions had increased; I had been momentarily conscious that the *Aufgabe* had not been fulfilled; this had consisted of facial, neck and shoulder tensions. Then (and now) I was not conscious of familiarity as such; the suddenness with which the color appeared, its persistence in focal consciousness with subsequent bodily relaxations, are all that I could say constituted familiarity. But my relaxation means to me a fulfillment of the task rather than an awareness of familiarity. The letter was 'b'; the bluish-black visual image meant 'b'."

5. *Observer A.* (Same instructions. The letter was 'q'.) "This process of recognizing was extremely rapid and involved only one movement of my finger. As before, I was at first conscious of the smoothness of the paper and of finger movement followed by the sharply localized blunt pressure of the lower point. I obtained the next two points as a bar, not two isolated points, with the focus of attention centered upon the mid-

space between them. This tactual-spatial perception was very fleeting and vague, and accompanied by a relatively much clearer visualization of the points in yellow-buff, raised upon the tag-board. With no intervening processes this visual imagery at once shifted to the reddish brown of 'f'; there followed a very attenuated perception of the upper two points of the figure, arranged as they came, in the form of a bar; this tactual-spatial perception lingered just long enough for me to 'catch' it and then shifted suddenly into the dark, pale, bottle-green of 'q'; the five points at no time became spatially arranged as a group either tactually or visually; the bluish-green of the 'q' appeared from above, rapidly covering the reddish-brown of the 'f', just as a curtain might fall and cover the one behind it. I had no sign of verbal imagery; the color of the 'q' covered a larger area on my finger-tip than did the color for 'f', the former being a larger letter. I was able to detect the manner in which the first color, meaning 'f', entered consciousness: it first appeared just above the upper joint at my finger tip and spread rapidly over the previously visualized points, covering the lower one last. In case of the 'q' the color appeared at the top, as did the 'f', first blotting out the upper edge of the colored 'f'-patch; it then spread downward until it formed a square area; then the left side of the square continued to 'grow' in a downward direction, forming a one-sided extension or appendage on the square. Thus the color, as it developed, shaped itself in the general form of the letter; it was only in terms of this shape of the visual image that I was conscious of the spatial arrangement of the points which go to make up the letter."

(*b*) *Summary of Introspective Data on Recognition*

Observer A. A's procedure in recognizing Braille letters may be summarized as follows. He first perceives the point or points with which he comes in contact. If the first point happens to be isolated, the tactual sensation momentarily lingers in consciousness; but if he comes in contact with two or more points simultaneously, he does not perceive these points as individuals, but finds that his attention is grouping them into a linear bar. For a brief instant this spatialization is tactual-visual, but tends at once to give way, entirely, to visual imagery of yellow points raised upon yellow tag-board. If the letter be a simple or small one, including not more than two or three points, there at once appears a colored area localized at his finger-tip. This area 'grows' into the shape of the letter, and the particular hue or brightness of this visual image constitutes either a tentative or final labelling of the letter. If, however, the letter is a large one, involving four or five points, this first color to develop may be a false recognition. The correction is made in terms of a new or second color which "drowns out," "covers," or "blots out" the preceding color. This last color to appear, the color which finally identifies the letter, is aroused by an antecedent consciousness the duration of which is so brief that it is reported merely as the awareness of "striking against something." The undeveloped consciousness of an additional point or bar of points in the figure serves to usher into focal attention the appropriate and final color. This undevel-

oped consciousness does not contain identifiable tactual elements. It is merely consciousness of "something."

Feelings of familiarity consist merely of the suddenness with which a color develops at the finger-tip, and the centering of attention upon the hue and shape of the colored area, with now and then a kinaesthetic process of anticipation or verification.

A's processes of recognizing, then, consist not essentially in the arousal of feelings of familiarity but in the *behavior* of colored visual imagery. If a color appears and runs its course with no interruption by the subsequent arousal of another color, the recognition is complete; if one color is superseded by another, the first constituted but a tentative or false recognition. In either case it is a color which has identified the letter in question.

(*c*) *Recognitions of A and B Compared*

B, like *A*, found himself arranging the points into bars or lines the instant they were detected tactual-motor fashion, and like *A* he was not aware of individual points as such unless they occupied an isolated position in the letter. In *B*'s case, as in *A*'s, the first spatial grouping of the points is vague, and does not include definite spatial limits; lines or bars are perceived as straight or as running in a certain direction; but at first their exact length or height is not perceived. In both reagents this vague tactual perception undergoes a process of clarification. *B*'s procedure here involves the appearance of a tactual image of the letter in which the bars or lines possess definite dimensions. In *A*'s case this clarification-process takes place in terms of visual imagery. Continued finger movement in both reagents results in prolonging and in further definitizing this spatial grouping of the points. In *B* the grouping is done in tactual-kinaesthetic terms; in *A* it is done in visual-kinaesthetic terms, the visual feature of the process beginning with images of the yellow-buff tag-board points spatially grouped as they are visualized, and ending in another colored visual image in which the individual points have lost their identity. This latter visual image identifies the letter by means of its hue and shape, principally by hue. This final grouping of the points in *B*'s case undergoes a similar dropping out of concrete and identifiable points; the spatial blend becomes perfect—the individual points lose their identity and appear as a grouped formation. This group is perceived as triangular, square, or what not, according to its form. But *B*'s mental content in this procedure is implicitly tactual, while *A*'s mental content is visual, the previous tactual processes receding or disappearing altogether.

To sum up *B*'s procedure in recognizing: there first appears a shift of attention from individual points to bars or lines; then

from bars or lines either to tactual imagery of a letter or to more definitely perceived spatial arrangements of these points. Here the points lose their individuality as separate bluntnesses and fuse into a spatialized blend; this latter process gives way to definite tactual imagery or to vocal-motor imagery of the letter. There is no visual imagery during the entire process.

Thus *B*'s processes of recognizing consist of the development of tactual and later of verbal imagery from tactual perceptions. *A*'s processes of recognizing consist of the development of visual imagery from tactual perceptions. The content which labels the letter in *B*'s case may be a tactual or a verbal image. In *A*'s case it is invariably a colored visual image of a certain hue, brightness or shape. These colors are identical with those which appear whenever *A* is thinking in terms of letters; they are the same as appear upon hearing the letters of the alphabet pronounced, and they are also the same as appear in his alphabet and number forms. Imagery of letters is invariably visual imagery of these colors and not tactual imagery.

The striking fact which is derived from a comparison of *A*'s procedure with *B*'s is the similarity in function in the two individuals but the marked difference in mental content. *A* recognizes letters by means of their synaesthetic visual associates, but the fact that *A* is synaesthetic does not render his processes of recognizing functionally different from *B*'s. Stage by stage the two individuals recognize in identical fashion. Both reagents must identify the object to be recognized; in either case the object must be labelled. *A*'s synaesthetic visual imagery is not an incidental and superfluous process in recognizing; there are no incidental or superfluous processes in *B*'s recognitions. *A*'s colored associates for letters identify or label those letters, as does *B*'s tactual or verbal imagery.

(*d*) *Significance of A's Synaesthetic Phenomena in the Process of Recognizing*

The temporal position of *A*'s synaesthetic visual images in processes of recognizing clearly points to but one interpretation, namely, that the visual associates are the essential components of the process and that they are integral parts of the development of meaning. The blurred tactual perception of points in the case of recognizing Braille letters, for example, means nothing to *A* except as a preliminary stage in the course of recognizing, for it must be definitized by visual imagery. Then, after the points have been perceived in their spatial arrangement through the aid of visual imagery, the object does not yet mean a certain letter rather than any other letter of the alphabet. This visualized grouping of points must undergo a change or be identified with the aid of some subsequent process. It hap-

pens to be a stereotyped colored visual image and hence a synaesthetic image which thus identifies a certain spatially arranged group of points as 'b,' or 'l,' or 'q,' or what not. A parallel procedure is to be found in *B*'s processes of recognizing; but the latter involve tactual and kinaesthetic contents in the place of *A*'s synaesthetic images. Where meaning develops in *B*'s case by means of rapid attention-shifts from tactual perception to tactual image or from tactual perception to verbal image, or from tactual perception direct to motor relaxation, it develops in *A*'s case by means of a rapid shift of attention from an undeveloped tactual perception to a visual grouping of points, and hence by way of a stereotyped visual synaesthetic image to motor response, or (in the more mechanized recognitions) directly from an undeveloped tactual perception through a synaesthetic visual image to motor response. In every instance, however, a motor response or relaxation will not label a letter; there must first appear a colored visual associate. There is no doubt, therefore, that the colored associates of letters *mean* those letters, in *A*'s case, and that without these colored associates the process of recognizing could not take place.

This fact gives us a clue to the functional significance of familiarity in processes of recognizing. If we compare *A*'s procedure with introspections obtained by Woods in her investigations of recognizing[2] we discover that *A*'s colored visual imagery functions as a substitute for the incipient organic and motor responses which her *O*s reported as feelings of familiarity. The shift from tactual to visual attention in *A*'s case means familiarity; colored visual associates function both as a general and as a specific label for the object recognized. We assume that a feeling of familiarity is but a species of development of meaning, and that in a general way it identifies the object to be recognized as "old" or as "belonging to past experience." Since in *A*'s case the color which appears in connection with a certain perception is always the same as the color which appeared with that perception in all previous experiences, the presence of the color itself in a subsequent experience *is* the familiarity of that experience. In other words, since the visual synaesthetic image is always stereotyped, it *is* the same experience which was had before. There can be no doubt about the identity or sameness of the experience. The invariable and stereotyped feature of the visual associate thus attenuates the process of "feeling familiar;" it provides implicit certainty in any subsequent recognition-process; it allows for no hesitation, wondering, or fluctuation of attention. Hence the relatively prolonged and laborious process of experiencing a feeling of familiarity is unnecessary

[2]This JOURNAL, 26, 1915, 313-387.

in *A*'s case; for an object or perception indefinitely labelled as familiar is by the same process labelled once and for all definitely and concretely. The perception is not only "old" or "familiar," but a definitely and finally identified perception at the same time.

When we ordinarily recognize as familiar an object, a face,or a name, we often have the experience of "knowing what the object is" or of "knowing the name of the person whose face is familiar," but we are unable to recall the appropriate name which will finally identify that object or person. *A* experiences a certain difficulty in recognizing which further demonstrates our point made in the previous paragraph and which stands out in contrast to the difficulty ordinarily experienced by an asynaesthetic person. *A* often has the difficulty of properly translating a colored visual associate into the appropriate name. He has already definitely labelled a person or object by means of his own color-language, but he has forgotten the name which translates that color into the English language. Thus, in teaching biology, he sometimes recognizes and as far as his own consciousness is concerned he has definitely and finally labelled a certain butterfly or crustacean. The colored visual image which stands for that species is present in his consciousness, but the technical name by which the species is generally known has escaped him. In such instances as these technical names, as such, are entirely superfluous to *A*'s processes of recognizing or of labelling. They mean to him only terms by which the identity of the species in question is made known to other people. We have come to use these technical names themselves as final contents which function in our own private processes of recognizing as well as contents which function in social communication. But not so for *A*, whose own private processes of recognizing are complete when the appropriate colored visual associate appears, regardless of the subsequent arousal of a technical name. We believe that this illustration shows further how synaesthetic phenomena not only serve as substitutes for other imaginal processes in acts of recognizing, but also function as substitutes for "feelings of familiarity." Synaesthetic phenomena function both as general and as specific labels for objects to be recognized.

We cannot understand how all this could take place unless synaesthetic phenomena are derived from, and are directly allied with, synaesthesia proper. When a person has synaesthesia, for example colored hearing, a certain blue means a flute tone just as much as the auditory quality itself, and probably more so. As far as meaning is concerned, that person sees the flute tone as much as if not more than he hears it. The color has come to function as an integral element in the process of perceiving. And so with the more prolonged and elaborate processes of perceiving which we call recognition.

A further comparative illustration will show how *A*'s processes of perceiving are not different functionally from those of asynaesthetic persons. When the senior writer hears a flute tone he finds that the focal standing-out of the mellow, woody, round-like quality, together with tendencies to visualize a flute or to say "flute," constitute the *meaning* of flute. It is the behavior of attention with respect to the auditory, visual and kinaesthetic qualities which are present in the act of perceiving which constitutes the development of meaning. And without tendencies to visualize or to say "flute" the tone would not be that of a flute any more than that of some other similarly sounding instrument. But let one sound a flute in *A*'s presence: the mental contents which appear are different, but they function as has just been described. *A* does not attend to the fluty qualities as such at all; in fact he hardly hears them. But something rises suddenly into focal consciousness to take the place of focalized auditory qualities, for no sooner is the flute sounded than a certain quality of blue arises to focal attention. So far *A*'s procedure corresponds exactly to the procedure of an asynaesthetic person. In the former, a visual quality has developed; in the latter, an ordinary quality has developed. Next, however, in *A*'s case, the hue or other qualitative feature of the visual image is recognized or identified. This particular hue or quality identifies the sound as coming from a flute. This procedure corresponds exactly to that of an asynaesthetic person, who has tended to visualize a flute or to say "flute," in that both persons have now by their final procedure recognized or labelled the flute tone. As long as *A*'s attention fails to take in the blue color in perceiving a flute, he does not know the sound of a flute from the roaring of a distant locomotive whistle. So long as a similarly functioning contextual image does not develop in the consciousness of an asynaesthetic person, the sound of a flute cannot be differentiated from any other sound. We conclude that in the very beginning of *A*'s mental life synaesthesia developed as an integral part of perceiving. His synaesthesia *is* the act of perceiving, itself.

A's synaesthetic images function in like manner in his processes of recognizing. While from the point of view of the asynaesthetic person *A*'s visual associates stand for something else and mean something else than visual images, we must not conclude that their functioning in consciousness is different from that of the asynaesthetic individual. In so concluding we forget that the process of deriving meaning even in perceiving and in recognizing demands the presence of some process other than the one recognized or identified. Certain contextual imagery is necessary, such as the visual or the vocal-motor mentioned above in connection with perceiving a flute tone. *A*'s synaesthetic images happen to constitute this contextual imagery.

3. Group 2. Auditory Method

The above experiments lead to the conclusion that synaesthesia is a phenomenon of meaning in *A*'s case. In order to determine whether our interpretation and findings were correct, a second series of experiments was performed on subject *A*, with *W* as check observer.

In this series of experiments various lists of nonsense-syllables were presented to the reagent in auditory fashion. Each list included one or more meaningful words having the same number of letters as the nonsense-syllables, and was so arranged as to make the process of introspecting upon the development of meaning as easy as possible. This was done by varying only one letter of the syllable each time, as for example: bih, bij, bik, bil (l); or fab, mab, sab, pab, lab (oratory); and the like. Thus *A*'s consciousness during the presentation of the series and up to the appearance of the meaningful word would not radically change and would be simple enough in content to make a very detailed introspection possible. The changes which would then appear, as soon as *A* became aware of a meaningful word, would stand out in contrast to the previous mental processes.

The instructions to *A* were as follows. "I am going to present to you a list of nonsense-syllables, auditory fashion, in which there will appear, sooner or later, a meaningful word. The instant you are aware of meaning respond by saying 'now'. I will then stop the presentations. You will be asked to give me a very detailed introspective description of the processes involved in the development of the meaningful process." The syllables were presented at 1 sec. intervals in order to prevent the arousal of associations and in order possibly to provide instances in which *E* might repeat a meaningful word without arousing a response on *A*'s part.

(*a*) *Introspective Data*

6. *Observer A.* Series: bih, bij, bil (l). Response at once to the word 'bil'. "As *E* was repeating the first two syllables I was at no time focally aware of the sound of his voice; each time, just as the sound commenced, I was aware only of 'something', non-focally; then I found that my attention was at once claimed by a dark, bluish, thick amorphous patch of color, about the size of one's hand; with this color I was aware, non-focally, of repeating the syllable in vocal-motor imagery; the development of processes following the presentation of the third syllable was very rapid. Just as *E* was saying the 'b' of 'bil (l)' there appeared the same blue patch as before, and as before I found myself vocalizing the syllable, but with the focus of attention centered upon the patch of color. In case of the preceding syllables the blue patch remained during the vocalization of the syllables, *i. e.*, the color did not change. But I no sooner found myself vocalizing the word 'bil (l)' than there appeared, extended off from the right side of the blue patch, an area of white, from the 'l' sound in 'bil (l)'; the color came in as if the blue patch grew outward toward the right, while the left side

of the patch retained its original blue; along with the appearance of the white I found my eye-movement tending toward the right with the growth of the visual image. No sooner had this extension of color appeared than I found myself responding in motor fashion; and as I was reacting I had faint visual imagery of a sheet of paper which was the beginning of a consciousness that the 'bill' meant to me a legislative bill; the immediate antecedent of my response was the extension of the blue patch; meaning appeared with this behavior of the visual image, and this meaning was subsequently made more concrete by the appearance of the visualized sheet of paper, which, in turn, was interpreted in terms of vocal-motor imagery, but after I had reacted. I forgot to mention that with the appearance of vocal-motor imagery of 'bil (l)' the blue part of the synaesthetic image increased slightly in size and became more saturated."

7. *Observer A.* Series: bop, bor, bov, boy. Response at once upon hearing the word 'boy'. "As before, the auditory perceptions of the first three syllables involved a shift of attention to visual patches, the color of which was the same blue as for the previous syllables, and which was determined by the 'b' sound in the syllables. As I perceived the 'b' of 'boy' there appeared the same blue patch; then as my attention lingered upon this visual image I found myself saying the word 'boy' in vocal-motor imagery, but only non-focally; here the qualities of the vocal-motor image are indistinct and vague, obscure and undefinitized; it would be impossible to describe its qualities because there are no distinguishable qualities present other than a general image of movement, localized in my throat. In exactly the same fashion as in the previous case, the blue patch then extended on the right, first into the light yellow of the 'o', and farther on into a brighter yellow of the 'y'; my attention was wholly absorbed in these color-changes, which seemed to develop rapidly of themselves. I then found myself responding."

8. *Observer A.* Series: cag, caj, caz, cat. "During this experiment I found that the color of the first two syllables was determined by the 'ca' sound of *E*'s voice. I set up for myself the subsidiary task of inhibiting my vocal-motor imagery in order to ascertain whether or not I was using it. As a result of this inhibition of vocal-motor imagery I was unable to perceive the 'cag'. The 'ca' sound aroused a smoky-blue white, but I was unable to tell whether or not it had any meaning. The color merely appeared and did not change. Just as *E* was repeating the second syllable I had vocal-motor imagery of the first syllable—the 'cag' which I had only imperfectly perceived before—whereupon I recognized the colors as colors for definite letters; my recognition consisted wholly of a rapid shift from vocal-motor to visual synaesthetic imagery. I had previously recognized that the colors for 'ca' stood for 'ca' by means of accompanying vocalization of the 'ca'-sound; this color had drowned out the color for the 'g'; in previous experiments I found either that the color for the last letter in the syllable was not entirely drowned out or that I vivified that color by vocalizing the last letter; when *E* said 'cat' I was already anticipating the smoky-white patch which stood for the 'ca'-sound; but no sooner was the word pronounced than I had vocal-motor imagery of the syllable together with focal visual attention centered upon an extension of the smoky-white patch toward the right into the reddish-brown of the 't'; I then found myself reacting."

9. *Observer A.* Series: vad, yad, zad, sad. "When *E* repeated the first syllable, I found my attention at once claimed by a patch of colors, the hue of which was determined by the letter 'v'; on hearing the second syllable this color was slightly changed by the difference in the sound of the first letter, 'y'; then I at once began to anticipate the appearance of the third syllable in terms of this same color; so that, just as the third syllable was repeated, my visual attention was already absorbed with this color;

but the instant the 'zad' was pronounced there appeared a conflict between the persisting yellowish-grey of the 'y' and a reddish-brown patch, which latter tended to appear with the auditory perception of the 'z' sound in 'zad'. The first stage of this conflict consisted of a 'shaking' or 'shivering' of the 'y' color; then the colors for both 'y' and 'z' began to smudge or mix together into a sort of 'emulsion' of color, in which spots and streaks of one color intermingled, spatially, with spots and streaks of the other color; then I found myself having vocal-motor imagery of 'zad', whereupon all trace of the yellowish-grey of the 'y' vanished and was replaced by a smooth patch or area of reddish-brown. This awareness of color-conflicts was accompanied by a developing motor attitude of dissatisfaction and unpleasantness, characterized by tendencies to frown, marked tensions in the throat, and tendencies to tighten about the chest and shoulders. But there then tended to appear the yellowish-grey patch of the 'y' accompanied by vocal-motor imagery of 'y'; this was but the beginning of a consciousness that the first letter of the syllables should begin with 'y'; I was trying to visualize all of the first letters of the syllables alike instead of the last letters; this reappearance of the color for the 'y' took place just to the left of the persisting reddish-brown of the 'z', and for a moment there was perceptible eye-strain of tending to look toward the right as my imaginal line of regard lingered in the direction of the 'z' color. By this time *E* had pronounced the syllable 'sad'; this happened just as my visual attention was beginning to shift for the last time from the reddish-brown of the 'z' to the yellowish-grey of the 'y'; the auditory perception of 'sad' was accompanied by a sudden appearance of a light yellow patch which at once superimposed itself on or 'slapped down' over the persisting greyer yellow of the 'y'; the next instant I found myself having vocal-motor imagery of 'sad'; and together with this verbal image the light yellow patch enlarged toward the right, changing into a dull greenish blue, indicating the 'd' sound of 'sad'; concomitantly with this shift or extension from the right-hand side of the yellow patch I was aware of a motor attitude of satisfaction, consisting of pleasantness, which was bound up with chest relaxations, of relaxations about the abdomen, throat and mouth. This response also served as an awareness that the task was over. During the entire process, however, my attention was focussed upon changing colors and brightnesses."

10. *Observer A.* Series: hov, hot, hom, hop, hok. The reagent did not react until *E* came to the syllable 'hok', when he responded at once. "Upon perceiving the first syllable there appeared a very definite and vivid chocolate-brown color representing the 'ho'-sound, so vivid that I found myself momentarily absorbed in gazing at the color as it persisted in the focus of my visual attention. Then, as I found myself having vocal-motor imagery of the syllable, meaning tended to develop. This consisted first of a tendency for the chocolate-brown color to extend on the right into a very light, yellowish white; then it seemed as if I should subsequently recognize the meaning, but I could not; this latter consciousness was a slight tendency to relax in the presence of the changing color. But the motor relaxation—about chest and face—had but just begun when it ceased to develop and I found my attention centered, visually, upon a persisting yellowish-white patch; I was gazing blankly at the extended colored patch. This gazing continued until the next syllable was pronounced. The brown of the 'ho'-sound then considerably brightened and became more saturated; my visual attention lingered on this color more focally than before, but still nothing happened; nothing new then happened until *E* pronounced the word 'hok'; up to this time I was merely having the synaesthetic imagery *plus* the verbal imagery of the syllables; upon hearing 'hok' I vocalized it as usual, but there at once developed on the right-hand edge of the chocolate-brown patch a reddish-brown, almost orange extension; I found myself responding; the word had meaning the minute

this change in the visual imagery took place. The response consisted of a general, diffused bodily tendency to relax, particularly about the throat and chest. This response seemed to me a recognition of the fact that the change in the visual image had meaning. I then said 'now'."

11. *Observer A.* Series: xap, wap, sap. "During the fore-period I was aware of increasing strains about the throat, chest and jaws. Upon perceiving the first syllable, the appropriate color appeared at once in the foreground of my visual field. Nothing new appeared in consciousness until *E* repeated the word 'sap'; at this juncture I was already repeating the synaesthetic image in anticipation of the coming syllable; as I vocalized this syllable there appeared to the left of the 'p'-color the light yellow of the 's'-sound. Together with this change in the visual imagery I found myself tending to relax, but this did not develop very far. Consciousness was claimed focally by tendencies to fixate my visual field more rigidly than before; I was moving my line of regard about the yellowish-white synaesthetic image of 'sap' which was still persisting; this was the beginning of a consciousness of wondering what 'sap' it was; then the colors in my visual field turned into a large green area, out from the bottom of which there developed a brownish form; this was the beginning of a consciousness that 'sap' referred to 'tree sap'; then a tree-trunk stood out, developing from the brownish form which had just appeared; and as my visual line of regard centered itself upon the tree-trunk I visualized beneath the bark a layer of white wood. This completed my consciousness that the 'sap' was 'tree sap'. During this time I was non-focally aware of greater and greater bodily tensions, located particularly in the chest and abdomen. These latter processes consisted of a tendency to inhibit the response until the meaning was complete. The meaning seemed to develop in the changing visual imagery, and my motor attitude seemed to constitute a recognition of the fact that meaning was developing."

12. *Observer W.* Series: qec, pav, muz, yix, log. (Owing to *W*'s tendency to anticipate meaning in series of syllables arranged as for observer *A*, a different type of series had to be presented him.) "First I was aware of tensions about the neck, in the throat and shoulders, and about the chest, having to do with a rigid bodily attitude of preparedness to react quickly as soon as a meaningful word might appear. As *E* (Mr. Cutsforth) read the syllables I found myself attending focally to each one in turn, tending at the same time to translate a momentary focal auditory perception of the syllables into visual imagery of the syllables printed in large black letters on a white background; immediately following each syllable my attention was claimed by the rapid fashion in which all auditory features dropped out of consciousness, and by a shift to consciousness of my bodily attitude which was just described; in the auditory perceptions the consonants tended to stand out far more prominently than the vowels; yet these sounds disappeared from consciousness almost as quickly as they appeared. When the word 'log' was given I found that my auditory attention developed to a higher state of vividness and more vigorously than in case of the previous syllables; the perception of the auditory qualities was more sudden; there seemed to be a different quality in the auditory perception itself, consisting of the dominance now of the vowel-sound instead of the consonant-sounds as before; while this auditory quality of the 'o' sound developed suddenly to a very high degree of clearness, I found myself already responding bodily. This bodily response consisted of an incipient tendency to pull my shoulders together, to bring my head forward, and to jerk slightly my entire right arm. While this motor reaction was going on, my attention was at first still centered upon the 'o' sound of 'log'. But no sooner had the 'o' sound developed to a maximal degree of clearness than I tended to visualize, dimly, in a background of white light, the word 'log'; this process did not develop very far, however; during

this time I was looking in the direction of *E*, and slightly to the right of my line of regard there appeared but the beginning stage of a visual image of a timber log, lying on its side. Merely the shape of one end of the log, faint suggestions of corrugations of bark, together with a dark brown color appeared with any distinctness at all. Accompanying this shift in visual imagery from the word 'log' to a visualized log the motor reaction which had already begun greatly increased in intensity and became a generalized motor 'set' in the direction of the visualized log. The entire reaction was so rapid and the motor processes so diffuse and widespread that I could not detect many of the kinaesthetic details; the more sharply localized tensions were in the throat and about the eyes; the diffused parts of the reaction seemed to be vaguely localized in chest and abdomen. (I think that if someone had asked me, at the time I was perceiving the word itself, whether or not it was meaningful I should have said 'yes', although at that time there was no process which seemed to tell me what that meaning was. But upon the appearance of the visualized log the meaning became definitized. This particular visual image was so fleeting and vague that I am surprised that it occupied the focus of attention. I was attending to it rather than to the motor background.) The motor background seemed to consist of an attitude of recognition which I assumed toward the visual image of the log; it seemed to consist, in other words, of a recognition of the fact that the processes had meaning."

(*b*) *Summary of Introspective Data on the Development of Meaning*

So far as our series of experiments is concerned, development of meaning consisted, in *A*'s case, (1) in the manner in which visual synaesthetic phenomena developed; and (2) in the arousal of a diffused motor and organic reaction which took place immediately following the development of the visual synaesthesia. The first stage has to do with the growth of meaning proper, and the second has to do with the reagent's recognition of the fact that meaning has developed or was beginning to develop.

In perceiving a nonsense-syllable, *A*'s attention shifts to a visual concomitant of the sound of the syllable even while *E* is pronouncing it. This visual associate is determined by the dominant or repeated sound in the series of syllables. As long as in the perceiving of these syllables no processes take place other than a vocal-motor image of the syllable, together with the visual concomitant, the reagent does not react; the syllable is meaningless. The verbal image appears with the aroused visual associate, and is sometimes repeated in order to clarify or prolong the visual associate itself, but the verbal process remains non-focal throughout. When a meaningful word is pronounced by *E*, *A*'s procedure of perceiving the word begins as do his perceptions of meaningless syllables; his attention at once shifts from auditory qualities to their visual associates. But from this point on his procedure is different; meaning begins to develop. The antecedent of this development of meaning consists of a non-focal verbal image of the word itself,

together with the persisting visual concomitant, which latter is the same for the verbal image as it was for the original non-focal auditory perception. Then the visual associate which is being attended-to focally extends, or grows in size, taking on additional coloration as it does so. These colors are the synaesthetic associates of the remaining letters in the meaningful syllable.

So far the development of meaning has passed through its first stage, but the process is not complete for the reason that as yet the meaning itself has not been recognized. The instructions were to react when meaning developed. Hence the reagent was disposed to recognize meaning itself before he reacted for the benefit of *E*. If, after these colors changed as just described, *A* did not find himself assuming a motor attitude, *i. e.*, responding bodily to the change, the process of meaning was halted in its course. Such an attitude included relaxations in the chest, throat, and sometimes abdomen, and organic disturbances which were interpreted to be pleasantness. Without such an attitude or without some further mental process *A* finds himself unable to interpret the change in the color. The change in the color means something, but what? Vocal-motor imagery will not come to *A*'s aid, for the vocal-motor imagery itself is non-focal and cannot be attended-to as such; moreover the change in the visual synaesthetic image which has already taken place has identified the verbal image so far as it can be identified. Thus, with no further mental processes other than a shift in the colors, *A* finds himself staring at them, blankly; the colors themselves are unfamiliar or meaningless until they, in turn, have been identified.

If, on the other hand, with this change or extension in the visual synaesthetic imagery, *A* finds himself reacting in organic-motor fashion as well, he responds to the syllable as meaningful.

So far in our analysis of the development of meaning we have traced its course through two stages—that of coming into existence and that of being recognized afterwards. But our development of meaning is yet incomplete. The meaning is still general. Sometimes *A* reacted when the meaning was still in this generalized form (introspections 7-10); he reacted before the concrete meaning had been defined by behavior of additional mental contents. Sometimes he went on and defined this meaning.

Thus, if there is in *A*'s behavior an implied *Aufgabe* to go on and define this meaning (see introspections 6 and 11) there takes place a third stage. A second change appears in his synaesthetic phenomena. The synaesthetic processes already present to consciousness give way to further visual imagery or to com-

bined verbal and visual imagery. These latter processes define the meaning of the word, specifically. For example, in one instance *A*'s visual attention shifted from synaesthetic imagery of the word 'bil (l)' to visual imagery of a white sheet of paper. This was *A*'s method of defining 'bill' as a legislative bill. Again, the yellowish-white synaesthetic image of 'sap' gave way to a rapidly developing visual image of a green tree, hence to a tree-trunk in which white wood was seen beneath the bark. This was *A*'s procedure in limiting or defining the general meaning of 'sap' which had already developed when the synaesthetic image of 'sap' appeared. During the development of this third stage in the growth of meaning the organic reaction, characteristic of the second stage, is prolonged and this reaction functions as a general motor background for the subsequent mental contents.

W's procedure is not different functionally from *A*'s, but with respect to mental content it is quite different. *W*'s attention is suddenly and focally claimed by the auditory qualities of the nonsense-syllables. But when a meaningful word is pronounceds, this auditory perception develops with greater vigor and to a higher degree of focality. This suddenness and ease with which auditory qualities stand out in consciousness corresponds to the sudden clarifying and extension of colors in *A*'s consciousness of meaning. In either case the meaning has not yet been recognized. The procedure of both reagents thus far constitutes an implicit recognition that the word is meaningful, but the meaning itself has not yet been recognized. If the development of meaning should stop here, *W* would have found that the word "seemed familiar" or was "about to turn into meaning" or "ought to have had meaning." Such an experience on *A*'s part may be found in introspection 10. From this point on the appearance of visual imagery in *W*'s case and the shift from visual synaesthetic imagery to further visual imagery in *A*'s case constitute final limitations or definitions of the meaning which has already tended to develop. A motor-organic reaction in either case constitutes a recognition of the meaning itself. The additional visual imagery (it may not always be visual in *W*'s case) is the stimulus which evokes a widespread motor attitude, intensifying the already existing attitude, and is also the content which defines the meaning of the word. The prolonged motor attitude, which was at first a recognition of general meaning, now becomes a recognition of defined or limited meaning.

Thus meaning develops as a dual process consisting (1) of shifting mental contents which determine the presence or absence of meaning and whether the meaning shall be general or specific—a stimulus function; and (2) of the development of a

motor attitude in the presence of these shifting contents which constitutes a recognition of this meaning—a response function. The contents function as stimuli and the motor attitudes as responses. If the first appear without the latter, meaning is not complete. The *O* is then conscious only that meaning began to develop but failed of recognition. Thus the full growth of meaning consists not only of the process-aspect of shifting mental contents, but also of motor responses in the presence of these process-aspects.

There exist the same temporal relations between the focal standing-out of auditory perceptions and the motor response of recognition in *W*'s case as exist between the appearance of a synaesthetic image and the motor response in *A*'s case. *W* testified that meaning began to develop when the auditory processes become highly focalized, and that it was his subsequent consciousness of a motor attitude, which seemed to constitute a recognition of this developing meaning, that enabled him to offer this testimony. *A* testified that meaning began to develop when his synaesthetic image "extended," and that it was his consciousness of a motor attitude, immediately afterwards, that enabled him to offer his testimony. Careful reviews of a mass of introspective data verify these interpretations. We believe, therefore, that synaesthetic phenomena and meaning are species of the same genus of mental functions. Synaesthesis is an integral part of every cognitive process in a synaesthetic reagent.

A synaesthetic phenomenon is but a type of behavior of attention; and this type of behavior, whenever and wherever it takes place, constitutes a process-aspect of mental contents which in turn constitutes meaning.

We do not propose to assume that the growth of meaning takes place in all *O*s and at all times just as we have described it; but we are confident that, so far as our own experimental method is concerned, and so far as our own synaesthetic reagent is concerned, mental contents function as they have been interpreted.

(*c*) *Significance of Synaesthetic Phenomena in the Development of Meaning*

Our results from this series of experiments confirm results from earlier series. (1) Synaesthetic phenomena function in differentiating meaningless from meaningful processes, and are thus cognitive phenomena as far as their function in mental life is concerned; (2) these synaesthetic phenomena are identical with their original prototypes, synaesthesis proper; (3) in the same fashion as visual associates stand for auditory, tactual-kinaesthetic or other non-visual processes, these visual

associates stand for meaning; and (4) the functional problem in synaesthesia and in synaesthetic phenomena is the same; this functional problem is identical with the problem of meaning.

4. Group 3. Tactual Method

In order to demonstrate the development of meaning under such conditions as would necessitate a slow growth, several words were stamped in American Braille and exposed to *A*, one at a time, but in tachistoscopic fashion. That is, each word was exposed suddenly and rapidly several times, before the individual letters grouped themselves into a meaningful word. The reagent was instructed to make rapid sweeping movements over the word as a whole, at 3 sec. intervals, until the word was recognized. After a practice-series was performed in order that *A* might learn the necessary finger technique, a regular series of experiments was presented. Since the following introspection is typical of all our results we include only one example.

(*a*) *Typical Introspective Datum*

13. *Observer A.* Word: good. "(I recognized the meaning of the word upon the fifth exposure.) As the tip of my fingers passed over the word, the first time, I perceived the letter 'd'. This perception developed as follows: at the outset I was aware only of indefinitely grouped blunt points; these points at once became arranged, spatially, in terms of visual imagery, and at the same time took on the poorly saturated bluish-grey of the 'd'; at this juncture the obscure tactual qualities, which had at first appeared, entirely vanished and the color of the letter persisted alone in consciousness as my awareness of the letter itself. The second time I inspected the word the color of the 'd' persisted in consciousness; I failed to add any letters to my consciousness of the word; there only appeared meaningless and confused jumbles of tactual impressions which, as fast as they appeared, shifted to visual, grey imagery—my synaesthetic imagery of the temperature of the paper. But during this second inspection I anticipated in terms of grey-blue color the 'd' at the end of the word and also in terms of hurried eye-movement toward the right as my finger was moving across the word; this grey-blue visual image was a small irregular area of color localised at the right end of a rectangular grey form, which latter represented the word as a whole. The third presentation resulted in perceiving the 'g'. My consciousness of the 'g' developed in the same fashion as did the 'd'; the very light greenish white color for 'g' persisting in its appropriate position with respect to the oblong block. The fourth inspection resulted in perceiving the second 'o', which appeared first as a meaningless and indefinitely grouped mass of blunt points; the pressure qualities at once shifted to visualized points, and then suddenly into the dark, smudgy black of the letter 'o'. The last time I inspected the letters my attention was being claimed by persisting visual imagery of the three which had been perceived; I was only non-focally aware of finger movement; just as my fingers touched the points between the letter 'g' and the second 'o' (the points which were to become the first 'o'), and before these points were given time to arrange themselves into the spatial grouping of a letter, there appeared very suddenly a visual synaesthetic image of a double 'o'; this latter process was built up by an extension which grew out from the left side of the already existing black smudge which represented the second 'o'; that is, this already existing smudge doubled in size, forming a bar instead of a

small patch of darkness. But no sooner had this 'oo' developed in terms of visual imagery than the colors for the single letters (which had up to this time been separated by small inter-spaces of grey background) suddenly merged into a continuously colored streak. In this merged visual image, containing three colors, my attention was not centered upon any one particular color, but upon the group of colors as a whole. Together with this merging of the visual imagery I found myself having the non-focal vocal-motor image: 'good'. When I discovered the first 'o' I noticed the beginning of a motor expectation, consisting of incipient forward movements of my shoulders and of increased throat tensions. (I interpreted this motor attitude as meaning anticipation of fulfilling the *Aufgabe* and also desire to find out the meaning of the word.) As the colors of the word were merging into a solid group I found myself relaxing bodily. I distinctly noticed that the colors began merging just antecedent to the appearance of the vocal-motor 'good', and continued beyond my awareness of this verbal process. I will now describe the merging more in detail. First the color for the letter 'd' slightly shifted its position toward the left until its edges met and fused with the right boundary of the black smudge of the 'oo'; then before this change in position had completed itself the colored patch representing 'g' shifted slightly to the right until its edges fused with the left boundary of the 'oo' smudge. As these edges fused or blended, the colors now representing the word as a whole imperceptibly 'ran into' one another, very much, I suppose, as the colors of a spectrum. I was aware of the shiftings of color before I attended to my developing motor response. The motor attitude itself seemed to mean anticipation and expectancy on the one hand, and a fulfillment of the task on the other. The merging of the colors meant to me a recognition of the word, and this merging was emphasized by the vocal-motor imagery."

(*b*) *Summary and Interpretation of Introspective Data on Tactual Presentations*

Two problems present themselves with reference to the results of this and the former series of experiments. One consists of the significance of verbal imagery in connection with *A*'s synaesthetic phenomena, and the other has to do with the significance of *A*'s motor responses in the development of meaning.

The temporal relationships between the appearance of verbal imagery and of synaesthetic visual imagery in this and the preceding series of experiments indicate that verbal processes contribute to the development of meaning. A synaesthetic image is aroused either by an auditory or a tactual stimulus; but before this synaesthetic image has run its course, *O* finds himself having verbal imagery of the syllable or of the word. Since the verbal process *is* the syllable or *is* the word, one would expect that ordinarily no further process would be necessary for the development of meaning. The verbal image ought to identify or to label the auditory or the tactual perception. In *A*'s case, however, the verbal image always remains non-focal. But invariably the presence of such an image is directly followed by a change in the synaesthetic image toward greater focality—the visual image becomes brighter, more saturated, more permanent. Hence the verbal image seems to

be the cue by which the dissociated synaesthetic image is definitized. Further evidence of this function of verbal imagery is found in instances in which a synaesthetic image persists, alone, after the original auditory or tactual stimulus has faded entirely from consciousness. In the absence of such a non-focal process as the persisting but vague auditory or tactual feature of the stimulus word, the persisting and now detached synaesthetic image *means* nothing. This fact suggests that not only is meaning the process-aspect of changing mental contents, but that the content toward which the shift is being made must begin to develop in the presence of the dwindling of the content from which the shift was made. And when a synaesthetic image lingers in consciousness beyond the duration of the stimulus-content which aroused it, it becomes meaningless the instant the non-focal stimulus-content entirely vanishes. Under these conditions *A*'s verbal imagery appears as a substitute for the original stimulus-content; this introduces a new process-aspect, a new shift of attention, now involving a verbal image as the content away from which attention shifts; and the persisting synaesthetic image is the content to which attention shifts. Thus a re-shifting of attention toward the synaesthetic content provides it with the lost meaning.

The question arises: does the verbal content provide meaning to the persistent synaesthetic image, or does the existing synaesthetic image now function to provide meaning to the verbal image, as it did to the original auditory or tactual stimulus? Since the synaesthetic image existed before the verbal image came in, we assume that the verbal process identified the visual (note, the visual, momentarily, had no meaning prior to the appearance of the verbal process); but the verbal process, in *A*'s consciousness, has no meaning until identified by a visual synaesthetic image; hence, upon the appearance of the verbal process, the persisting visual process which lasts longer than the verbal subsequently defines the verbal process itself. This accounts for the fact, perhaps, that the visual synaesthetic image becomes intensified or clarified upon the appearance of the verbal process. It not only was identified but it, in turn, identified the process which had just identified it. This interchangeableness of stimulus and response functions, or of cause and effect, is not inconsistent. Logically, causes and effects and stimuli and responses must be interchangeable to function at all.

As to the second problem—the significance of *A*'s bodily motor responses in the development of meaning—our data from the present series of experiments furnish us with important suggestions. A careful study of *W*'s introspections in contrast to *A*'s shows that the former reagent lays much more stress upon kinaesthetic processes in the development of meaning

than does *A*. We have explained that these kinaesthetic processes evidently functioned as contents of recognizing the meaning of a word or syllable as it began to develop. The meaning was the "object" recognized, and the motor response was the recognition of the "object." But *A* showed fewer motor tendencies than did *W*. Evidently, then, something aside from motor tendencies in *A*'s case sufficed in the recognition of meaning, once that meaning began to develop. We interpret this difference between *W* and *A* to mean that in the former reagent processes of recognizing meaning are more explicit or overt, while in the latter reagent these processes of recognizing are more implicit; that is, they are to be assumed in the behavior of his synaesthetic imagery. We have already seen how in *A*'s case synaesthetic imagery labels an antecedent mental content both in a general and in a specific manner, thus attenuating "feelings of familiarity." This fact in itself means that *A*'s recognitions of meaning tend to take place implicitly because of his synaesthetic phenomena.

It is evident, however, that as far as meaning is concerned colors and their behavior alone do not suffice when a given train of associations terminates in a synaesthetic image. To possess meaning, *A*'s synaesthetic colors must themselves be recognized, or they must function as if they were recognized. One procedure by which these colors are recognized when they occur in prolonged sequences is by a shift of attention from one color to another. The product of this shift defines the antecedent color, implicitly. But if a train of visual associations fails to lead to a further shift in visual imagery, the development or the course of meaning is halted. Here the reagent must resort either to verbal or to other kinaesthetic processes. The final color is then recognized by means of a motor attitude. Thus, as long as colors keep changing from one to another, meaning is present for the time being, and whether or not such colors shall suffice to produce meaning depends upon whether or not the behavior of colors fulfils either an implicit or an explicit *Aufgabe*. Thus, in our last experiment, colors sufficed not in themselves but because they united the letters of the word "good" into the word "good." This union of colors satisfied the *Aufgabe*. In introspection 13 the behavior of colors did not satisfy the *Aufgabe*, for it led neither to a further change in colors nor to a bodily relaxation. Hence the colors meant nothing. To return, then, to a comparison of *W* and *A*, *W* habitually fulfils *Aufgaben* by resorting to complex motor attitudes along with changing visual, auditory, and other imagery; *A* can fulfill the same tasks by juggling visual contents, and with less kinaesthesis. But the instant visual synaesthetic contents cease to flow, *A*'s motor responses come at once to the rescue.

We can conclude, therefore, that the behavior of synaesthetic phenomena in our synaesthetic reagent is an adequate substitute in focal consciousness for the motor responses which were more important in our check reagent. But our synaesthetic reagent must have motor responses constantly on tap in a case of emergency. A careful examination of his introspective data shows that such motor responses are constantly on tap as a dim and oftentimes unnoticed background. He attends to changes in synaesthetic phenomena as long as they run their course; but if these synaesthetic images fail to run their course, he becomes conscious at once of the failure of the motor background to run its course as well. *A*'s mental life is characterized by a synaesthetic tendency to 'see' everything. The motor background which develops with the growth of meaning, and which came to the front so many times in *W*'s introspections, is not noticed by *A* for the same reason that auditory or tactual processes are not noticed. Visual surrogates symbolize them all. So *A* is over-determined or predisposed to find meaning in his synaesthetic images rather than in motor adjustments, in the same fashion as he is over-determined or predisposed to "see" sounds rather than to "hear" them. But just as auditory qualities in his colored hearing determine the behavior of the visual associate, and operate as a necessary background, so in the development of meaning the motor attitude is a necessary background for the behavior of detached synaesthetic images.

It is because the reagent is attending to *visual* rather than to auditory qualities when he hears sounds that it seems as if he were "seeing" sounds rather than "hearing" them. It is because his attention is centered upon visual qualities when he calls up *auditory* imagery of a sound that makes it seem to the reagent that he has auditory imagery when in reality no auditory qualities are present. And because his attention is centered upon shifting visual contents as meaning develops, rather than centered upon motor contents, he finds meaning in the former rather than in the latter. In every instance the process attended-to is the one which the reagent interprets as the bearer of the meaning. In every instance the last process attended-to—the last to run its course—is interpreted to be the content of the process of recognizing the preceding content. Hence *A* finds meanings in motor attitudes only when visual accompaniments cease or when a motor response terminates a given series of experiences.

All of this is illustrated by introspection 13. While the asynaesthetic reagent would probably have interpreted his motor attitudes as concerned with the development of meaning, as did *W*, *A* interpreted his motor responses as having to do

with fulfilling the *Aufgabe;* they meant expectation or completion of the task. Had colors not dominated *A*'s consciousness, it is most likely that his bodily relaxation at the end of the experiment would have meant the core of his recognizing the word "good," and would have been a response to the vocal-motor image "good." As it was, however, the merging of the colors was the core of his recognition-process, and the accompanying motor attitude which did not claim his attention until afterward was interpreted as a fulfilment of the task, not as a reaction which had to do with recognizing the word "good." Since the recognition of the word "good" was the fulfilment of the task, recognizing and fulfilling a task are here identical. *W* would have chosen the first meaning of the two; *A* chose the second because he is synaesthetic, and the behavior of his synaesthetic imagery meant the process of recognizing. Hence the motor response meant something else. In *W*'s case the motor attitude would have meant both, on second thought.

5. Conclusions

The real cognitive function of synaesthetic phenomena now becomes apparent; for (1) the appearance of colors in the first place constitutes developing auditory or tactual perceptions on the one hand, and (2) the further behavior of these colors constitutes shifts from one meaning to another as (for example) trom letter-meanings to word-meanings; (3) the behavior of these colors acts also as a surrogate for motor responses in focal consciousness, as long as the motor phenomena are present as an unnoticed background; (4) synaesthetic phenomena behave in such fashion that they can mean the fulfilment of a task; (5) meanings fail to develop in the absence of the appropriate behavior of synaesthetic colors; (6) synaesthetic imagery constitutes the context for meaning; (7) synaesthetic images operate as a substitute for feelings of familiarity; and (8) synaesthetic images 'label' or 'interpret' the 'object,' making it meaningful.

It is significant to note that in no instance did meaning develop for any reagent until a motor attitude or visualized motor attitude attended other sensory or imaginal contents. This fact suspiciously points to the conclusion not only that kinaesthesis is an essential component of the consciousness of meaning, but also that a motor response is necessary for the development of meaning.